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WASHBURN & GILLIS ASSOCIATES LTD.

ENVIRONMENTAL AND ARCHAEOLOGICAL REVIEW OF THE PROPOSED TRANS-CANADA HIGHWAY (ST. LEONARD TO ST. BASILE)

SUBMITTED TO: DEPARTMENT OF TRANSPORTATION
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FILE: DOT-90-6

Mr. Brian McEwing
Assistant Director
Department of Transportation
P.O. Box 6000
Fredericton, NB
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Dear Mr. McEwing:

RE: Report: Archaeological and Environmental Review of the Proposed Trans-Canada Highway (St. Leonard to St. Basile)

We are pleased to submit the report entitled "Archaeological and Environmental Review of the Proposed Trans Canada Highway (St. Leonard to St. Basile). This report contains a summary of the project phases conducted during the study and the conclusions reached.

We trust that you will find this report meets your requirements and we would be pleased to discuss it with you at your convenience.

Yours very truly,

Gregory F. Gillis
President

SF/pdw

Enclosure

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1.0 INTRODUCTION

The Department of Transportation is proposing to realign a section of the Trans-Canada Highway north of St. Leonard. Regulation 87-83 of the Clean Environment Act, states that all such major highway projects must be registered with the Minister of Environment prior to project commencement, so that the Minister may determine whether an Environmental Impact Assessment is required concerning the project. From this project registration, the need for a survey to determine the existence of environmentally sensitive areas and human heritage resources was identified during an initial review of the proposed alignment by The Department of Environment. The Department of Transportation was advised this survey would play a key role in the Minister of Environment's final decision on the necessity of a full EIA.

To fulfil this requirement, The Department of Transportation retained the services of Washburn & Gillis Associates Ltd. to conduct an environmental and preliminary heritage assessment of the proposed project.

1.1 Project Setting

The proposed corridor departs from the present alignment of the Trans-Canada Highway just west of St. Leonard at the Grande River Road and extends northwesterly, crossing the Grande, Siegas, Quisibis and Green Rivers, plus several smaller streams. The proposed corridor is entirely within Madawaska county. Situated between the larger communities of Grand Falls and Edmundston, the project area is rural in nature.

The proposed corridor crosses several family farms and woodlots. Away from the Saint John River, the study area passes through a few small scattered communities along lines of communication and at crossroads. The largest industrial employer in the study area is the Irving lumber mill at Grande River. The corridor is nearly 31 kilometres in length, and while generally 200 metres wide, ranges in width from under 100 metres to 500 metres. The terrain is typically hilly with elevations from 135 to 250 meters above sea level. While considerable hills do occur, significant portions of the study area were formerly covered by Glacial Lake Madawaska; these areas are more rolling in nature (See Figure 1-1) (Rampton et al. 1984, de Jonge 1951, Kite & Borns, 1980).

1.2 Project Definition

Construction activities associated with the proposed project will involve the clearing of trees and other vegetation, and the disturbance of soil matrices within the alignment corridor both on the surface and at various depths. This may result in the:

i) loss of flora and destruction of associated habitats;

i) alteration of, or damage to stream habitats;

iii) loss of wildlife habitats; and,

iv) destruction of archaeological sites, or the loss of or damage to architecturally significant structures;

The scope of the study, as defined by the Departments of Environment, Transportation, and Tourism, Recreation and Heritage, is to identify and inventory the

GREEN
RIVER
Davis Mill
SMYTH
BROOK
ST. BASILE
SAINT-BASILE
MADAWASKA CO
AROOSTOOK COUNTY
BANGOR AND AROOSTOOK
PLAINE DES
CTE-DE-MADAWASKA
RIVIERE
SAINT
MAINE
NEW BRUNSWICK
CANADA
PLATIN
UNITED STATES-OF-AMERICA
ETATS-UNIS D'AMERIQUE
St-David
Fournier
Grand Isle
Madawaska
Rivière-Verte
Green River Stn
Grand Isle T
Madawaska T
1+000A
1+000B
2+000
3+750
4+500
5+000
6+200
8+750
9+500
10+000

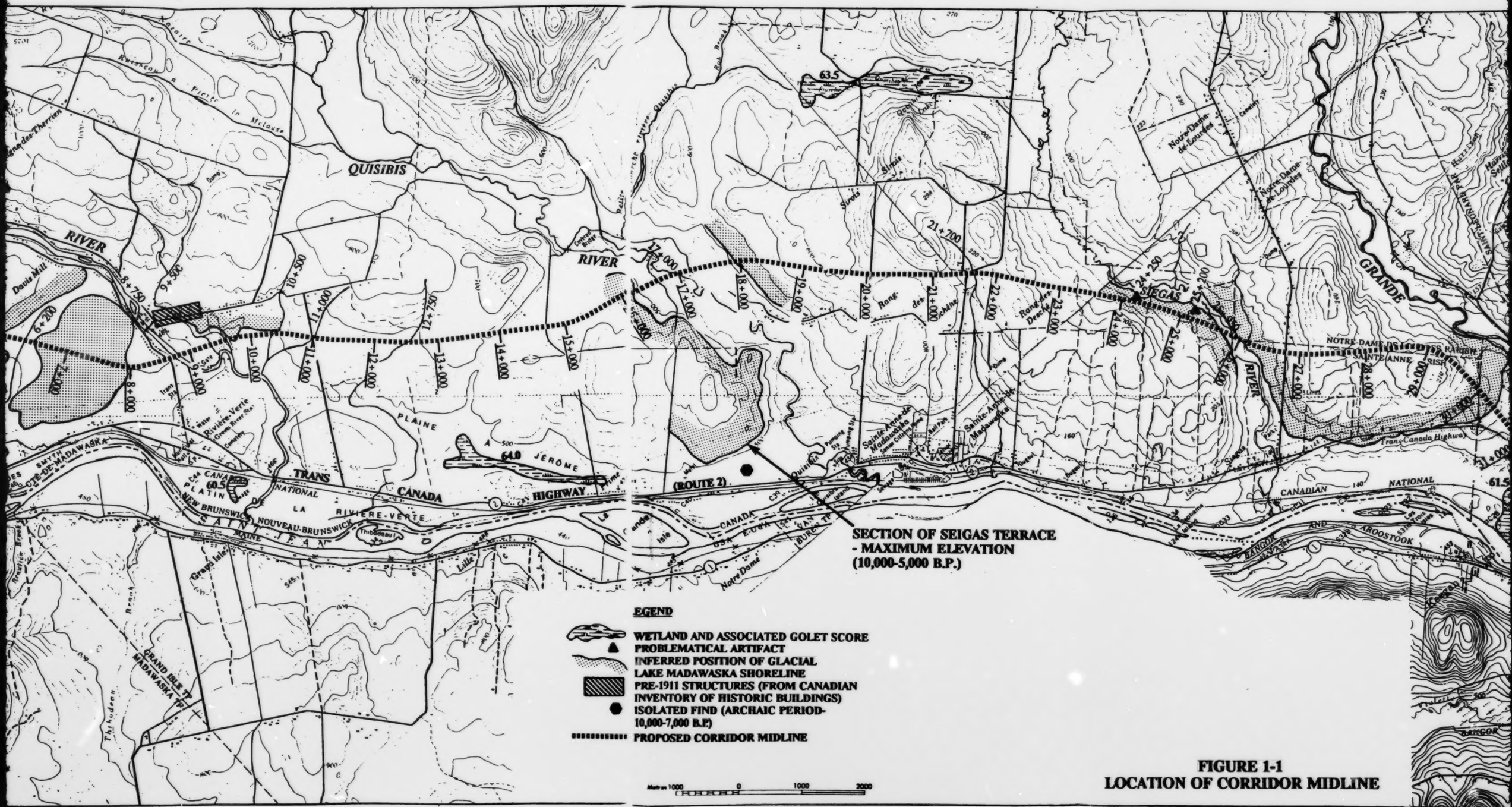

FIGURE 1-1
LOCATION OF CORRIDOR MIDLINE

GRANDE
RIVER
NOTRE-DAME-DES-ANGES PARISH
SAINTE ANNE PARISH
Trans-Canada Highway
NATIONAL
CANADIAN
AND AROOSTOOK
ST. LEONARD
MADAWASKA CO
SAINT
AROOSTOOK CO
Van Buren
BANGOR AND
Harrison Brook Settlement
Grand Boisseau
Violette Settlement
SAINT-LEONARD PROVINCIAL PARK
Reservoir
Brook
61.5
22+000
28+000
31+000
31+250
OR MIDLINE

occurrence of these environmental resources and heritage sites within the corridor so that they may be adequately considered throughout the planning process. To assist in this project, sensitive environmental and heritage resources were identified.

The study called for a three-phased approach. Phase I involved developing methodologies, conducting background research and contacting various resource specialists. Phase II entailed the collection of field data. Phase III comprised analysis of information gathered in Phase I and II, and report preparation.

1.2.1 Identification of Environmental Components At Risk

Based on these activities, 3 environmental components at risk (ECAR's) have been identified:

1) Rare/endangered flora
2) Sensitive stream habitat
3) Sensitive wildlife habitat

Regulation 82-248 under the Endangered Species Act protects rare and endangered plants and their habitats. In this study, rare or regionally rare plants are described as:

- Indigenous species having a small population within the province due to biological characteristics, or because it occurs on the fringe of its range, or for some other reason. It may be restricted in a small area, or it may occur sparsely over a larger area.

- Threatened flora are those indigenous species that are likely to become endangered within the foreseeable future over all or a significant portion of its range in the province if factors affecting its vulnerability are not reversed.

- Endangered plants are any indigenous species in danger of immediate extinction throughout all or a significant portion of its range owing to human action.

For the purposes of this study, sensitive stream habitat included salmonid fish habitat. The economic and recreational importance of trout and salmon warrants their protection under the Federal Fisheries Act. Although other fish occur throughout the study area, the sensitivity of salmonids to habitat degradation has deemed them a recognized indicator species.

In terms of sensitive wildlife habitat, while emphasis was placed upon wildlife species or populations which presently are protected under the Endangered Species Act of New Brunswick, other wildlife concerns were examined through discussions with various biologists. The white-tailed deer (Odocoileus virginianus) population, due to its socio-

economic importance, was one such concern. The wildlife section also examines special considerations related to the placement of the corridor with respect to sensitive habitats including wetlands, riparian zones, and deer wintering areas.

1.2.2 Identification of Heritage Resources at Risk

To ensure responsible management of non-renewable heritage resources, archaeological fieldwork undertaken in New Brunswick is licensed by the Province through the Department of Tourism, Recreation and Heritage. Fulfilment of licence requirements calls for specific information. This report is designed to serve the dual function of supplying the Departments of Transportation, and Tourism Recreation and Heritage their respective requirements.

The Archaeology Branch of the Department of Tourism Recreation and Heritage, developed terms of reference specifically for this project. As stated in that document; "The purpose of this heritage resource evaluation is to identify and address any concerns with regard to heritage resources that could result from the proposed new Trans-Canada Highway corridor between St. Basile and St. Leonard, Madawaska County", (Archaeology Branch, 1990).

Further, in Section 5 of the Terms of Reference, four Specific Objectives of the project are set out:

5.1 To identify, inventory and evaluate all sites of archaeological, historical, and architectural significance (heritage sites) within the project boundaries.

5.2 To supply all data in enough detail to be incorporated in the Provincial heritage site inventories.

5.3 To identify and assess all impacts this proposed undertaking will have on the heritage sites identified.

5.4 To make recommendations and propose mitigative measures to counter the effects this undertaking will have on heritage sites" (Archaeology Branch, 1990).

2.0 ASSESSMENT OF ENVIRONMENTAL RESOURCES AT RISK

2.1 Rare Flora

Prior to fieldwork existing botanical literature was reviewed. Contact with relevant specialists was made, and the Connel Memorial Herbarium of the University of New Brunswick was consulted for information concerning the distribution of rare or endangered flora that may be found in the area. Interpretation of colour air photography isolated several areas that displayed environmental conditions necessary to support certain rare plants. Potentially rare or sensitive habitats were identified on 1:10,000 mapping. Each of these habitats was visited and examined on October 6 and 7, 1990. Also examined were areas adjacent to transecting or close approaching roads. The areas examined totalled approximately ten linear kilometres.

The vegetational cover of the area under consideration varies greatly. Existing within the corridor are several areas of old fields and fields under cultivation. Areas not cultivated consist of second and third growth mixed woods, and some alluvial bottomland. Alluvial bottomland is dominated by balsam poplar and heavily cut over arbor-vitae and larch forest. No old growth forest occurs along the corridor.

Furbish's Lousewort (Pedicularis furbishiae Wats) is the only plant presently protected by provincial legislation as an endangered species. It is not known to exist within the corridor. Although no rare plants were encountered, some uncommon species of vascular plants were observed to grow within the corridor.

2.2 Stream Habitats

Streams encountered in the study corridor are a part of the Saint John River watershed. Topographical mapping, (1:50,000) and 1:10,000 ortho-photos were examined to determine location and condition as well as access to watercourses. To evaluate stream habitats, a literature review was undertaken and fisheries biologists were consulted regarding salmonid habitat in the study area.

Fieldwork was carried out on October 16, 17 and 18, 1990. Streams along the corridor were evaluated as to whether they were permanent or intermittent. When stream flow and safety conditions permitted, permanent streams were measured and data were collected downstream of the estimated midline of the corridor. Data were collected detailing stream gradient, stream width, approximate slope of bank, degree of bank undercutting, description of substrate, water depths, and vegetation cover. General comments such as presence or absence of fish species, environmental conditions of immediate area, and water conditions were recorded. Streams were filmed on 8 mm audio/video cassette.

The terminology for habitat types used in this report is taken from the 1985 Fish Habitat Field Manual prepared by the Department of Fisheries and Oceans and New Brunswick Department of Forest Mines and Energy. For the purpose of this study, a riffle is where water velocity is increased because river depth or width is less than the average. Healthy, non-degraded riffles do not contain deposited silt. A pool is water that is wider and deeper than average, with slow velocity. Pool bottoms are often composed of silt,

debris, and sand. Flats are sections where water flows are shallow and slow with a smooth surface. The bottom is relatively featureless and composed of rock, silt or fine sand. A run is defined as swift deep flowing water, usually with a bottom of rubble and boulders. Particle names and sizes are given in TABLE 2-1.

TABLE 2-1
Terminologies and Categories For Particle Size

Name of Particle	Range of Size in MM
BEDROCK	Solid Rock
BOULDER	256.0 - 4000
COBBLE	64.0 - 256
PEBBLE	16.0 - 64
GRAVEL	2.0 - 16
SAND	0.062 - 2.0
SILT	< 0.062
SOFT CLAY/MUD	

Throughout the fall of 1990 the province received abnormally high amounts of precipitation, causing the majority of waterways to overflow and change in appearance. The effect of these conditions on the waterways was recognized during the stream habitat survey. While some sections of the stream descriptions may reflect high water conditions, potential salmonid habitat present could still be analyzed. Fast and deep water at several crossings (e.g. Quisibis, Grande, Green, Siegas) made instream measurements dangerous and unattainable, however, assessments of the habitat potential, were possible.

Several small streams were determined to be of little habitat value. Some were simply drainage ditches through fields (e.g. on Figure 1-1, located at 19+050, 19+400), others were intermittent streams (e.g. 14+250) and yet others were drainage for alder or cedar bogs and had little or no water flow (e.g. 2+250, 17+725). Streams of this nature are not included below.

The following is an assessment of habitat quality in the streams surveyed. It is appropriate to note that while the habitat features listed below are significant, there may also be other factors limiting salmonid habitat potential.

- Streams 1+000 "A" & "B" join at the northern limit of the corridor near the midline. Neither has potential salmonid spawning, nursery or rearing habitat, predominantly due to insufficient water and the lack of cover as it passes through a field.

- Smythe Stream (3+750) has both salmon and trout rearing habitat potential.

- Stream 4+500 has potential trout rearing habitat.

- Stream 6+200 has no salmonid spawning, nursery or rearing habitat potential mainly due to insufficient water flow, but also as a result of a lack of shading and lack of sufficient substrate.

- Green River (8+750) has potential salmon and trout spawning, nursery and rearing habitat.

- Stream 9+500 was observed as having trout present and as having potential trout rearing habitat.

- Stream 10+500 has no salmonid spawning, nursery or rearing habitat potential, predominantly resulting from open, un-shaded conditions and a lack of adequate substrate.

- Stream 11+000 has no salmonid spawning, nursery or rearing habitat potential predominantly due to insufficient water flow, little shading, and lack of adequate substrate.

- Stream 12+750 has no salmonid spawning, nursery or rearing habitat potential predominantly due to the poor quality substrate and an insufficient water flow.

- Quisibis River (17+000) has trout and salmon rearing habitat potential, as well as a some potential spawning and nursery habitat.

- Stream 21+000 has good potential trout rearing habitat.

- Siegas River (25+950) has potential salmonid spawning, nursery and rearing habitat.

- Grande River (31+250) has potential salmonid spawning, nursery and rearing habitat.

2.3 Wildlife

Resource managers and biologists familiar with the area were contacted for information regarding presence or absence of rare or endangered species, range of species in the area, population sizes, location of sensitive wetland and waterfowl areas, habitat types, and other relevant data. Discussions were held with wildlife ecologists concerning proposed mitigative measures. Research reports, and other literature containing data relevant to the project were reviewed. A range of mapping including a wetlands atlas and forest development survey maps were utilized to delineate habitats.

For this study, wildlife resources have been divided into four groups consisting of three broad animal categories and one pertaining to sensitive habitat types: birds, mammals, other wildlife and sensitive habitat. The clearing of vegetation and soil disturbance will result in a reduction to the present available habitat within the corridor. While this may negatively modify land use by some species, others may be attracted to the new habitat conditions.

2.3.1 Birds

To date, three avian species (all raptors) are declared endangered under the New Brunswick Endangered Species Act: the bald eagle (Haliaeetus leucocephalus), the osprey (Pandion haliaetus) and the peregrine falcon (Falco peregrinus anatum). This latter species is also classified endangered by the Committee On the Status of Endangered Wildlife In Canada (COSEWIC).

There is no known bald eagle nest site in the area under consideration or its proximate surroundings. The area is not known to be used as nesting habitat for peregrine falcon (R. Stocek, personal communication, 1990).

Currently, osprey populations have recovered to the extent that New Brunswick authorities are considering the removal of this species from the provincial endangered species list. The area is not known to be inhabited by any major concentration of osprey (R. Stocek, personal communication, 1990).

2.3.2 Mammals

The New Brunswick Endangered Species List includes two mammal species; the eastern cougar (Felis concolor) and the Canada lynx (Lynx canadensis). Cougar populations and locations in the province are unconfirmed, as the available data consists solely of unofficial sightings reported over the past decade. Lynx populations are considered to occupy mainly the northern part of the province, although some individuals in the recent past, have been seen as far south as in Charlotte County, N.B. (R.

Cumberland, pers. comm., 1991). The Department of Natural Resources and Energy (DNRE) does not have any data available pertaining to lynx population sizes or location.

The proposed rerouting of the Trans-Canada highway is outside Crownland and, thus, the area is not specifically inventoried for the presence of notable wildlife species or sensitive wildlife habitats by DNRE. But a major portion of the corridor is situated within or in close proximity to numerous agricultural fields, harvested woodlots, or other man-disturbed areas. This is not typical cougar or lynx habitat. It is therefore, not expected that the project will significantly impact either of these or other mammal species (N. Prentice, per. comm., 1990).

2.3.3 Other Wildlife

Currently, there is no species of insect, amphibian, or reptile in New Brunswick which is considered endangered under the Endangered Species Act. Resource managers have indicated that the study area is not known to support any species or populations which should be included in the Act (T. Thomas and R. Webster, pers. comm., 1990).

2.3.4 Sensitive Habitat

2.3.4.1 Wetlands

Wetlands are highly productive habitats which sustain or attract a rich variety of animal species. Wetlands also act as natural filters, with freshwater wetlands protecting the water quality of downstream areas. While reducing flooding and erosion by storing

water and stabilizing stream flow, wetlands recharge the aquifers in unconsolidated soils. Wetlands act as natural fire breaks and provide recreational areas for bird watching, canoeing, nature studies, hunting, trapping, etc.

Until recently, the importance of wetlands to wildlife, and as a geological feature, has been underestimated. As a result, wetlands have been subjected to degradation, infilling etc. Recently, an effort has been made to bring many wetland areas back to a more natural state, while promoting the positive aspects of this habitat type.

All wetlands over 0.25 ha in size throughout the Maritime Provinces have been inventoried as part of the Wetland Protection Mapping and Designation Program coordinated by the Canadian Wildlife Service of Environment Canada. A habitat diversity index, called the Golet Score, was applied to individual wetlands to gauge their relative importance to waterfowl and other wildlife. Freshwater wetland scores range from 36 to 108 points with the more productive wetlands generally scoring above 65 points.

Review of the New Brunswick Wetlands Atlas and discussions with Ducks Unlimited Canada have shown that little if any wetland habitat will receive direct impact by the project within the corridor of the proposed routing (A. MacInnis, personal communication, 1990). However, the highway will cross numerous brooks and rivers, some of which are part of the watershed of three wetlands representing some value to wildlife; scoring 60.5, 64.0 and 61.5 on the Golet scale (Figure 1-1). Disturbance of upland areas could have a negative impact on these wetlands if runoff is not controlled.

2.3.4.2 Riparian Zones

As mentioned previously, the project will cross numerous brooks and rivers of various sizes. Like wetlands, riparian zones, those areas along banks of natural watercourses, are known to be a very important feature of wildlife habitat. Containing a vegetative structure that is often unique, very diverse and multi-layered, these are highly utilized by animals, including deer, as travelling corridors and they serve as links between different types of habitat (Elliott, 1988). This is particularly true in the winter, as streamside zones usually offer good travelling conditions in terms of relatively low snow accumulations and adequate hiding cover. Riparian zones should therefore be afforded protection during construction and maintenance of the highway.

2.3.4.3 Deer Wintering Areas

In the latitudes where the project is located, winter represents a critical season for deer. Harsh weather, combined with snow accumulations, restrict deer to areas offering good shelter from winds and deep snow (i.e. mature softwood and mixed wood stands), but where nutritious food items are usually rare or absent. Deer must therefore cope with the worst environmental conditions while consuming the poorest quality food. This makes good quality winter range essential for their survival and productivity (Armleder et al. 1986).

Discussions with the DNRE personnel and review of deer wintering area maps show that within or in the proximity of the study area, there is no known deer wintering area or any area supporting any high deer activity. The project is not expected to have a significant impact on white-tailed deer habitat (N. Prentice, personal communication, 1990).

3.0 ASSESSMENT OF HERITAGE RESOURCES AT RISK

3.1 Methodology

3.1.1 Phase I

Department of Transportation 1:2000 maps were examined to determine the general position of the corridor. As well, aerial photographs were examined to better understand the terrain and determine geological features. The corridor was subdivided into 123 survey sections. Each 250-metre section was identified by its distance from the St. Basile end of the corridor and plotted on 1:10,000 maps.

3.1.1.1 Heritage Resource Potential Modelling

Existing information on heritage sites along the corridor is very limited. The problem is compounded by poor accessibility along the corridor. The scope of the study did not require that the entire length of the corridor be examined. For these reasons a predictive model based on environmental factors was developed. The model assisted in determining areas of heritage potential by identifying environmental factors frequently associated with the occurrence of heritage sites.

Environmental criteria for the model are derived from the characteristics of known heritage sites in the Maritimes-Maine area. The model also incorporates known heritage locations. As well, the model considers natural alterations of river channels and changes in water levels as a result of glaciation.

The predictive model was employed in two stages. First, the model gave a numerical value to every section according to its potential for heritage resources. Those sections scoring high in potential were selected for consideration during field examination. Resources were divided into four categories:

Group I:	paleo Indian, early, and middle archaic
Group II:	late archaic, ceramic, contact
Group III:	historical resources
Group IV:	other predictive location factors.

For each category, a point score was assigned for specific prehistoric, historic, geologic and environmental features. The total point score for Group I was 9, for Group II was 29, for Group III was 19 and for Group IV was 6. A section was considered for field work if it had any of the following point scores:

- any Group I score; or
- 3 or more Group II points; or
- 3 or more Group III points; or
- 5 or more Group IV points; or
- 10 or more points from all four categories.

This process resulted in the elimination of 60 of the 123 sections for consideration for field work.

The remaining 63 sections, were then divided (based on heritage potential) into low, medium, and high categories. A section ranked "low" would have scored either 10 - 12 points or points in one or two Groups other than Group I. A section ranked "medium" would have scored either 13 - 15 points, points in three or four Groups other than Group I, or one point in Group I. A section ranked "high" would have scored between 16 - 20 points or more than one point in Group I.

This second stage of model application determined that 25 sections scored low, 18 sections scored medium, and 20 sections scored high. About one quarter of each of the low and medium sections, (randomly selected), and all of the high sections, were chosen for field inspection. Altogether 29 sections were selected (See Appendix 2 for results of model application).

3.1.1.2 Additional Analysis

In addition to the intensive review of topographical and orthophotographic maps and the application of the predictive model, Phase I entailed a literature search, a review of various government files, and contact with researchers familiar with the area's geology.

A focal point of geological research was the identification of pleistocene landforms, particularly the former shoreline of Glacial Lake Madawaska. The inferred shoreline of Lake Madawaska, in the area of the corridor, was plotted on 1:10,000 maps and transferred to Figure 1-1.

3.1.2 Phase II

In Phase II, field reconnaissance of the study area was initiated. Although the proposed route had not been surveyed at the commencement of field work, Department Of Transportation crews flagged and cut the midline in sections of the corridor as the archaeological reconnaissance progressed.

Under Archaeological Field Research Licence 90NB13, sections of the corridor were examined over a six day period between October 23 and November 6, 1990.

For each of the sites selected for investigation, all locations where natural or cultural forces had exposed either plan-views or soil profiles were examined. Such locations included stream banks and beds, tree throws, gravel pit wall profiles, surfaces exposed by erosion, road beds, ditches, and fields. Shovel test units were used to examine stratigraphy and to search for evidence of cultural activity. At some locations, 35 mm photographs were taken showing topographical and geological features.

3.2 Results of Heritage Resource Assessment

3.2.1 Published Evidence

The earliest periods of human occupation of the area relate not to the present course of the Saint John River, but to the shores of the defunct Glacial Lake Madawaska. Several geological events and the subsequent erosion of pleistocene landforms would have

had a profound effect on Paleo and Archaic sites that might exist within the corridor. Finding sites of this antiquity within the corridor will depend on the placement of the corridor with respect to undisturbed Holocene landforms.

Twenty-three thousand years before present (23,000 B.P.), as the Upper Saint John River Valley became ice free, it was inundated by the DeGeer Sea. Later, around 12,300 B.P. this body of water became part of the Inland Sea Acadia when the Reversing Falls at Saint John, due to geological factors, rose above sea level. Glacial Lake Madawaska was a northern extension of this water body. Based on sediments and fossils various theories have been set forth as to whether Glacial Lake Madawaska was a marine, an estuarine or lacustrine environment. It is presently felt that a lacustrine environment was the most probable scenario (A. Seaman, pers. comm., 1991). Eventually as isostatic uplift exposed the bedrock at Grand Falls, water levels dropped and Glacial Lake Madawaska became a separate entity from the remainder of Inland Sea Acadia. During part of this time Glacial Lake Madawaska may have drained northward to the St. Lawrence River Via Lac Temiscouata and Riviere Rimouski (Rampton et al., 1984).

Deglaciation may have been a result of rising sea levels which would downdraw the icecap and cause calving. The proximity of a massive ice cap to the ocean, and large quantities of cold glacial runoff would chill the ocean. Lower ocean temperatures reduce snowfall, eventually halting the development of ice fields.

Prior to 12,600 B.P. unglaciated areas are thought to have been treeless tundra. Coastal areas were dominated by herbaceous tundra, while inland some birch may have been present. As warming continued and ice continued to retreat, poplar and dwarf birch was succeeded by spruce along the coast. In the study area, sea levels were generally dropping. By approximately 11,000 B.P. the setting would have been similar to that of north central Quebec. Over the following 1,500 years a more open forest may have developed, with an increase in birch and a decrease in spruce (Rampton et al., 1984).

Upon entry into the Holocene period, which dates from 10,000 B.P. to the present, the entire area was devoid of glacial events. Generally, the central part of the province underwent crustal uplifting, while coastal areas were subjected to submergence. This caused changes to occur along the Saint John River Valley resulting in alluviation beginning about 10,000 B.P., but being most active between 9,000 and 4,000 B.P. In the Saint John River Valley this alluvium is still being transported and redeposited as the river continues to evolve.

Geologists have known about Glacial Lake Madawaska since the mid 1880's when lacusterine features in the upper Saint John River Valley were first documented by Chalmers (de Jonge, 1951). Glacial Lake Madawaska extended 130 km from Grand Falls up the Saint John River Valley and into the Madawaska River Valley beyond Lac Temiscouata, Quebec. Although Glacial Lake Madawaska is thought to have been deepest at its inception, a possibility exists that this was not the case. The development of the best beaches took place while the lake level was stable. Stable lake levels occurred late in

development of Lake Madawaska, when water level was controlled by the rock ledge at Grand Falls. Geologically speaking, the lake rapidly shrank in size after ca. 10,000 B.P. when the blockage at Grand Falls deteriorated.

It is probable that pre-historic groups followed the retreating ice in search of herds of game that may have included caribou, musk-ox and mastodon. Bonnichsen, Nicholas, and others feel that there may have ..."been a continuous occupation of diverse environments in the interior throughout the Holocene, and possibly back into the late Pleistocene" (Nicholas, 1982). In this case, it is very probable that Paleo and Archaic period peoples would have utilized the shores of Glacial Lake Madawaska. Sanager feels that there was not continuous occupation of the northern Maine-New Brunswick area until after 3000 B.P. Sanager hypothesizes that most sites in the area are associated with established transportation routes linking the Saint John and St. Lawrence River systems. Other suggested reasons for area utilization are the high general resource potential, and the diversity resulting from transition from a glacial lake to a riverine system.

Much of the evidence has been destroyed by wide spread erosion of early Holocene landforms. Identification of Holocene landforms such as former Glacial Lake Madawaska shorelines increases the potential of finding Paleo and Archaic period sites. In the area of the corridor these shores have been inferred by following the 150 m to 160 m contour on topographical mapping.

As early as 1955 geologists examined and described the shoreline of lake Madawaska thus:

"Beaches and bars are most numerous near the 525-foot (160 m) contour level in the basin of extinct Lake Madawaska, but are absent from higher elevations. The position of the 525-foot contour thus represents the inferred position of the highest Lake Madawaska strand line. A well-developed beach ridge about 5 miles northwest of St. Jacques is 1/4 mile long, 10 feet high, and about 50 feet wide, and is composed of slate pebbles shaped like pumpkin seeds." (Lee,1955)

..." Their structure consists of small shingle pebbles lying flat one above the other, or overlapping in a manner of tiles on a roof." (de Jonge, 1951)

..."In all the beach ridges the gravels have the form of pumpkin seeds. In fact there are no beaches which are not made of shale shingles,..." (de Jonge, 1951)

"Many beaches stand out as ridges shaped like railroad embankments a few feet high, more often they form distinct benches or terraces." (de Jonge, 1951)

"The length of individual beaches appears to depend on regularity of topography. At only two places were beaches found to reach about half a mile in length; elsewhere the irregularity of the valley slopes strictly limited their development. (de Jonge, 1951)

"...Small gravel pits are often dug in beaches on farms, a fact which helps locate them" (de Jonge, 1951).

During the prehistoric and early historic periods the Grande River was the most important watercourse that crossed the corridor. This is primarily based on its use as a transportation route. Two portages at the headwaters of the Grande allowed travel across the province, joining the Saint John River system to the Restigouche system. Travel up the Grande by canoe is easy to the Wagansis. From this point a 2 mile portage is taken to the Wagan. "Wagan" is thought to come from the Micmac "O-wok-un" meaning "a

portage". The Wagan empties in the Restigouche and is a fairly easy trip. This route was the main route between the Saint John system and the Bay of Chaleur, and is generally thought to be the most important route across the province (Ganong, 1899).

The Green River Valley has been described as being a youthful, broad, "u"-shaped valley. One possible Glacial Lake Madawaska beach ridge exists on the east wall of the valley (Lee, 1955). The Green River is fast and difficult to navigate, however there was a portage to the Kedgwick River (another swift river with many rapids) that because of its difficulty, was thought to have been used only by hunters (Ganong, 1899).

The Quisibis River valley has many rapids in what has also been described as a youthful valley. This valley has numerous meander scars, ox-bow lakes and, behind the lakes, undrained swamps. Beach bars from Glacial Lake Madawaska are found along the lower end of the valley at the 160 metre contour (Kite and Borns, 1980).

Little historical information is available on the last of the major watercourses that crosses the corridor, the Siegas River. It is thought that "Siegas" comes from the Maliseet "Sayegosk" which possibly means "obstructed river", or "flat at the mouth". In the historical period, the spelling changed several times "Shiegask" (Sproule 1787), "Shiegas" (Grant 1794), "Shiegash" (Sproule 1799, Saunders 1842, Gesner 1847), and "Seyagis" (Land Petition 1801). It was not until 1859 that the present spelling was used by Wilkinson (Rayburn, 1975).

Kite and Borns, in their 1980 discussion of late glacial and Holocene geology of the middle Saint John River Valley, refer to a geological feature known as the Siegas terrace. Sections of the terrace can be traced from Grand Falls to Edmundston, and is described as the highest of the alluvial terraces in the valley. This feature occurs outside the corridor, along the Saint John River Valley. They suggest that this terrace holds great archaeological potential for the Paleo and Archaic periods since man was in New Brunswick during the later stages of the existence of Glacial Lake Madawaska. Further, some Glacial Lake Madawaska beaches are contemporaneous with a Paleo site at Debert, Nova Scotia. "Paleo-Indian sites may be located on, or just above, these relic lake shores. The alluvial stratigraphy of the Seigas terrace spans most of the period between 10,000 B.P. and 5000 B.P., during which time there is little known about man in Maine and the Maritimes. The Siegas terrace probably contains sites that could fill this void in the archaeological record. Sites of this age within the Siegas terrace may have a well-developed stratigraphy in which each artifact assemblage is temporally separated from other assemblages. Late Holocene artifacts probably occur in surface sites on the Siegas terrace, surface and buried sites on younger alluvial terraces, and buried sites on the present-day floodplain." (Kite & Borns, 1980).

One Holocene period artifact from an area of the Seigas terrace has been registered with Archaeological Services of Tourism, Recreation & Heritage under the Private Collections Program. The artifact, a bi-pointed ground stone tool has been

tentatively dated to the early Archaic period (A. Ferguson, personal communication, 1991). The tentative date of this artifact (10,000 to 7,000 B.P.) corresponds to the dates of the terrace suggested by Kite and Borns (10,000 to 5,000 B.P.) (Kite and Borns, 1980). While spurs of this feature may enter some of the river valleys that cross the corridor, it is not expected that the Seigas terrace would extend as far as the corridor. Figure 1-1 shows the relationship of this section of the Siegas terrace to the location of the Archaic artifact.

3.2.2 Field Reconnaissance

The Canadian Inventory of Historic Buildings established certain criteria by which buildings may be judged for their heritage value. Basic criteria, including architecture, history, environment, usability and integrity, are subdivided and graded.

No buildings or structures meeting such criteria were encountered or were previously registered within the corridor. There are eight pre-registered structures that are located outside, but within 500 m of the corridor. Seven of these structures are clustered north of the corridor near the crossing of the Green River by the road from Montagne-de-la-Croix. These structures range in function from an outhouse (1900), shed (1900), and barn (1880), to several single dwellings (1880 - 1911). The eighth structure is located in St. Basile south of the corridor. Although the exterior appears to date to the last quarter of the 19th century, it has been dated to 1784. The present structure may be built upon a foundation from the earlier period, which would explain the earlier date (Figure 1-1).

Area residents were questioned about the presence of native artifacts. In all but one instance the reply was negative. The positive reply was nebulous and was based on a prehistoric artifact made of limestone. Limestone outcrops are known to occur 2 1/2 miles east of and 1/4 mile northwest of St. Anne de Madawaska (Kite and Borns, 1980).

In the study area highway crossings hold little potential for historic period sites. If sites of this nature occurred at corridor/highway crossings, they would likely be post 1800.

Gravel pits, although allowing for excellent inspection of soil profiles, produced no solid evidence of prehistoric periods. They did provide several interesting examples of geological events, or features which are discussed below.

Problematic 'artifacts' occurred at two locations. Both locations had initially been identified as being on the Glacial Lake Madawaska shoreline. Although within Glacial Lake Madawaska deposits, it is now felt that these positions are not necessarily on the shoreline of the glacial lake. A bone fragment was recovered from a talus slope of an erosional face in a low profiled gravel quarry at 24+250. The area was thoroughly examined, but no further material was recovered. Examination of the 20mm bone showed one side of the fragment was cortex, and indicates the bone was from a large animal, probably mammalian, and possibly a rib fragment. The bone was water-worn and had not been exposed to the air for very long (F. Stewart, pers. comm., 1991). The deposition of the bone is not thought to be the result of anthropogenic activity.

The second problematic artifact (C. Turnbull, P. Allen, A. Ferguson, per. comm., 1991) is a water-worn, flake-like rhyolite. It was recovered *in situ* from the profile of a gravel pit, approximately 50 cm below the surface. This area, located at 25+200, was re-visited and examined in detail, with negative results. Upon examination of a photo mosaic of approximately 10m of soil profile it appears that there is no A or B horizon soil development. The upper soil layers are more or less homogenous silt, clay and gravels. These rest on lacusterine gravels, which does not fit geologic theory. It is therefore suggested that the original surface has been mechanically removed during gravel quarrying operations. The present surface represents a redeposition of a mechanically mixed matrix on top of lacusterine gravels (A. Seamen, personal communication, 1991). Given the above scenario of recent deposition, and the questionable nature of the lithic, this site while in Glacial Lake Madawaska deposits, has no heritage value, and the flake is viewed as a result of natural agents (Plate 1). Appendix 3 summarizes the reasons that each 250 m section was examined and briefly comments on each section.

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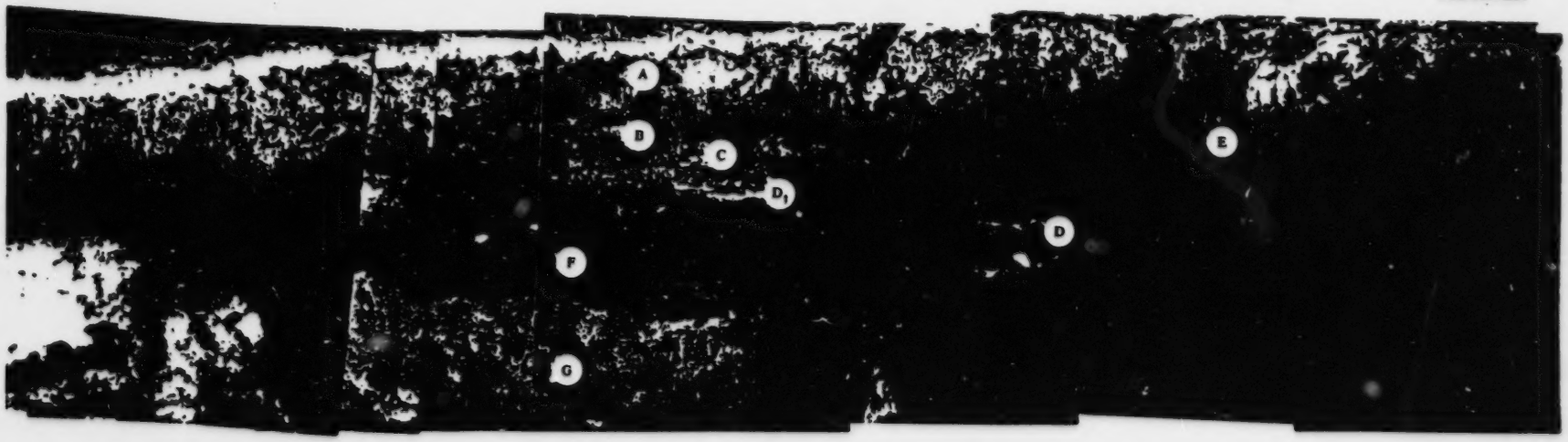
SOUTHEAST

NORTHWEST



A. Sod, loosely matted, bush and grasses
B. Mechanically deposited silts and pebbles, pale browns
C. Dark organic lense, possible short term surface
D. Silt, pale grey and black
D_1. Location of problematical
E. Rodent hole
F. Lacustrine gravels, some oxidation, various colours: grey, black, brown, reddish brown
G. Unexcavated talus

0 0.5 1 METRE

PLATE 1
SOIL PROFILE
GRAVEL PIT 25+000
ELEV. 150 M (GEODETIC)

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

No rare or endangered flora or critical natural areas were found during the survey. The alignment appears to have been wisely chosen to avoid areas that might be of ecological importance. Some uncommon species of vascular plants were observed within the corridor but these are widely distributed and are not considered threatened.

Most watercourses within the corridor are not critical as spawning, nursery or rearing habitats for salmononids. There are eight streams and rivers that are important because of their potential for salmonid habitat, and several of these rivers are known to be salmon rivers. Given appropriate mitigative measures, the proposed project, will have a limited impact on stream habitat within the corridor.

Discussions with resources managers have shown that the area under study is not known to be inhabited by any insect, amphibian, reptile, avian, or mammal population which is or should be looked upon for its inclusion in the New Brunswick Endangered Species Act. Furthermore, the proposed project, by altering the present habitat in the corridor, will displace but not threaten resident species and populations. The populations to be displaced are well represented throughout the province. Certain areas such as wetlands and riparian zones are heavily utilized by several animal species.

As no archaeological or architecturally significant sites are known to exist along the corridor, it appears that the placement of the corridor should not have a significant impact on heritage sites. Eight structures registered under the Canadian Heritage Building Inventory are situated approximately 0.5 kilometres outside the corridor. While most of these structures date to the early part of this century some date to 1880, with one possibly dating as early as the 1780's. None of these structures are presently protected under Federal or Provincial legislation. Construction activities will not physically impact these resources.

Based on discussions with geologists, and a review of the literature, the corridor is known to cross the former shoreline of Glacial Lake Madawaska in several localities. It is acknowleged by archaeologists that Paleo and Archaic period man was in the Maine/New Brunswick area during the life of the lake. The current archaeological understanding is that the shore of the lake was utilized by these early prehistoric groups. Presumeably, small populations would have made use of locations along their travels that were for some reason(s) considered favorable. Construction activities will destroy or disturb these high potential areas if they occur along the proposed route.

4.2 Recommendations

4.2.1 Stream Habitat Resources

It is recommended that the New Brunswick Department of the Environment Watercourse Alterations Technical Guidelines (1987) be followed. Particular attention should be given to guidelines relating to;

- Guidelines for Bridges - minor obstructions
- Guidelines for Culverts - minor obstructions
- Guidelines for Debris Removal
- Guidelines for Tree and Brush Removal
- Guidelines for floodwater Diversion Channels
- Fishery Concerns - Timing of Inwater Work Projects

4.2.2 Wildlife Resources

Given the level of effort required to address the mitigative measures outlined in Section 4.2.1, it is recommended that the effort be expanded to allow passage of small mammals from one side of the highway to the other at major water crossings. This could be accomplished through the retention of a 10 m setback of natural habitat by passing the highway above and over water crossings via a bridge.

It is recommended that bridge structures with travelling lanes be utilized at the following water crossings;

- Grande River
- Siegas River
- Quisibis River
- Green River
- Smythe Stream

Culverts are not recommended for use as travel lanes.

4.2.3 Heritage Resources

Application of the predictive model for heritage sites identified areas with the greatest potential for encountering significant archaeological and architectural sites. While the model was based on environmental criteria that are known to be associated with heritage sites, there is the possibility of sites being overlooked. To remedy this it is recommended that areas of significant potential are monitored. Monitoring is meant to assure that significant heritage resources are not lost during early grubbing or surface removal, and will entail a visual examination of exposed soils for such evidence as artifacts, soil stains or other evidence resulting from human activity. Monitoring is a passive activity in the sense than a minimum of collecting or excavation is carried out. An archaeological permit is not required for this action.

It is recommended that during the construction phase, several areas be monitored by an archaeologist for possible heritage resources:

1). Glacial Lake Madawaska shorelines at the following locations, if soil removal or disturbance occurs;

a. 4+500 - 5+000

b. 5+500 - 6+000

c. 10+000

d. 18+000

e. 24+000 - 26+000

f. 30+000 - 30+750

2). And at the following major watercourse crossings if soil removal, or disturbance occurs;

a. Green River from 8+500 - 9+750

b. Quisibis River from 16+750-- 17+250

c. Siegas River from 25+750 - 26+000

d. Grande River from 30+750 - 31+750

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APPENDIX 1
HABITAT DATA FOR SELECTED STREAMS

1+000 "A"

On the midline at 1+000 two small streams join. "A" is the farthest north. This stream is fast moving water with a gradient of 2.9%. The width on average is 1.50 m with an average depth of approximately 10 cm. The stream is very regular and straight, "ditch-like", no pools exist. Substrate consists of some sand, gravel, pebble, cobble and a few boulders. Banks are heavily grassed with some shrubs which provide 100% stream cover, in some areas, however, the stream runs mainly through an open field. The banks are under 2 m high, but steeply sloping, approximately 30°.

1+000 "B"

This stream flows into 1+000 "A" at 1+000 on the midline. It resembles 1+000 "A" in that it flows rapidly through the same field. The stream consists mainly of riffle zones with a limited number of pools. The majority of substrate is sand and mud, little instream grass exists. The stream is 0.5 m wide with a maximum depth of 30 cm. Upstream the stream flows through a mixed forest stand and an alder stand which provides 100% cover. The stream gradient is 3%, with banks of approximately 0.5 m and sloping at approximately 45°.

(3+750) R. des Smythe

This river passes under a dirt access road, causing water to backup forming a pool. On average the river is 2 to 3 m wide with pools as deep as 50 cm and riffle, flat and run zones of 20 to 40 cm deep. The stream gradient is 2.8 % and the water moves

quickly. Stream cover, provided by an alder stand is as high as 100%. The banks are very low and stable with alder and grass growth. Very little instream grass exists but instream debris is present in the slower flowing areas. The river braids as it flows around alder patches. The substrate is gravel, pebble and cobble.

4+500

A stream with 50 cm deep pools and 30 to 40 cm riffle areas. With a gradient of 2%, the stream flows through an alder stand providing 100% cover in most areas. Stream width is 1 to 2 m with low banks and shallow slopes. There is considerable instream grass, and substrate consists of gravel, sand and pebbles.

6+200

A meandering stream, flowing very slowly through open wetland. With a stream gradient of 1%, the stream is 0.5 to 1.5 m in width and 40 cm deep, in most areas. Pools are only slightly deeper(50 cm). Stream cover is tall bank grass and a few sparsely positioned alders. The banks are low, vertical, and drop directly into the stream. Instream grass is plentiful and the stream bottom is very soft silt and mud with considerable debris.

(8+750) Green River

One of the main rivers in the study area, approximately 50 to 60 m wide with pool, riffle, flat and run areas. While a wide variety of substrate exists from sand to boulder, there is a large amount of gravel, pebble and cobble. Stream cover is limited due

to river width and high human pressure. Banks are steeply sloping, around 45°, erosion exists but is not extensive. The river is fast flowing with a stream gradient of 0.14%.

9+500

The stream flows along the edge of a rough field and new tree plantation within a mixed forest stand. A few alders grow in the stream but the majority of the 100% stream cover, comes from the bank vegetation. The stream enters Green River approximately 300 m downstream. Instream cover is provided by instream debris and grass. Substrate is mainly mud and sand but a little gravel exists. Banks are not high but steep sloping in areas and with the small amount of erosion undercut banks, and approximately 40 cm deep pools provide good fish shelter. Grass, shrubs and alders maintain the bank integrity from extensive erosion. The stream gradient is 0.1% and the stream width is between 1.5 and 2 m.

10+500

This branching stream flows in a narrow valley, with steep walls, through a sparse alder stand. The stream is braided, fast running and shallow with maximum depths of 40 cm. The width of each braid fluctuates from 1 to 2 m. The stream gradient is 2.0%. Stream banks are generally low except where the stream contacts the valley wall, which slopes at approximately 45° or more. Sparse stream cover is provided by deciduous trees, alders and grasses. Instream cover consists of much debris and grasses. Substrate is mainly sand and mud.

11+000

A very small stream which exits a mixed forest and runs through tall grasses before flowing under a secondary road and through a field. The depth is 37 to 40 cm and shallower, the width is 0.5 m and less. The stream gradient is 0.3% which accounts for still to slow moving water. Substrate is mud and sand, while some areas of the stream flow over grass.

12+750

A small shallow stream flowing through an alder stand in a mixed forest. Erosion is very limited throughout the stream. Bank cover is 100% and instream cover is provided by forest grasses and alders. The stream flows through a very narrow valley and is braided into many small streams by alder stands. Hard substrate is limited and is predominately silt with a little gravel. The stream gradient is 5.5%. An old farm road dams one section of the stream creating a small quiet pond.

(17+000) Quisibis River

The Quisibis River is generally slow-moving with mainly flat and run areas and a few pools. The gradient of the surveyed sections of the river was 0.09%. The river is approximately 15 to 20 m wide with deeper and slower water along the banks. The substrate is mainly gravel and sand with some cobble and pebble. This meandering river cuts through low and slightly eroding banks. Bank cover is tall grasses and alders but there is little overhang.

21+700

The stream, bordered by alders, meanders through a sparsely forested area. Erosion of the very low undercut banks is slight and not extensive. The stream width varies from 0.5 to 1.5 m with riffle zones and small pools up to 30 cm deep. The average depth is 15 to 20 cm, with a stream gradient of 3%. There is very little instream grass and substrate is mainly mud, sand and gravel with a few pebbles and little cobble. Instream debris is not extensive.

(25+950) Siegas River

Another quick moving river with a variety of pool and riffle habitat. Substrate ranged from silt and gravel to a few boulders. The stream gradient is 0.3%. A beaver dam occurred in the corridor with water above the dam deeper and slower moving. The banks of the river, throughout the corridor section studied, were generally shallow sloping and low, up to a maximum of 1 to 1.5 m, and vegetated with alders, mixed forest and grasses. Erosion existed but was not extensive.

(31+250) Grand River

A fast moving river with highly vegetated banks, sloping 30° to 45°. The river gradient is 0.1 %. Grand River is deep and 20 to 25 m wide. At the point of crossing the river exhibits straight regular flow with no pooling. Substrate is mainly gravel pebble and cobble.

APPENDIX 2
RESULTS OF HERITAGE RESOURCE MODEL APPLICATION

RESULT OF MODEL APPLICATION

SECTION KM+M	I	II	III	IV	TOTAL	RANK	SCORE
1+0	1	4	1	5	11	8	M
1+250	0	0	1	3	4		
1+500	0	0	1	3	4		
1+750	0	4	0	6	10	9	L
2+0	0	4	0	6	10	9	L
2+250	0	0	0	4	4		
2+500	0	4	0	6	10	9	L
2+750	0	0	1	4	5		
3+0	0	0	0	3	3		
3+250	2	0	0	4	6		H
3+500	2	4	1	5	12	7	H
3+750	1	5	0	6	12	7	M
4+0	0	0	0	3	3		
4+250	0	0	0	6	6		L
4+500	3	4	1	6	14	5	H
4+750	3	0	1	3	7		H
5+0	1	0	1	3	5		M
5+250	0	0	1	3	4		
5+500	1	1	0	3	5		M
5+750	3	0	0	4	7		H
6+0	0	7	0	6	13	6	M
6+250	2	0	0	5	7		H
6+500	0	0	0	4	4		
6+750	0	0	1	4	5		
7+0	0	0	1	3	4		
7+250	0	0	1	3	4		
7+500	1	0	1	3	5		M
7+750	2	0	1	3	6		H
8+0	0	0	1	3	4		
8+250	0	0	1	4	5		
8+500	0	12	2	6	20	1	H
8+750	0	9	1	6	16	3	H
9+0	0	0	0	5	5		L
9+250	0	4	0	6	10	9	L
9+500	0	4	0	6	10	9	L
9+750	1	0	0	3	4		M
10+0	1	0	0	4	5		M
10+250	0	8	0	6	14	5	M
10+500	0	4	0	4	8		L
10+750	0	4	1	6	11	8	L
11+0	0	0	1	5	6		L
11+250	0	0	0	2	2		
11+500	0	0	0	2	2		
11+750	0	0	0	2	2		
12+0	0	0	0	2	2		
12+250	0	0	0	3	3		
12+500	0	0	0	5	5		L
12+750	0	0	1	5	6		L
13+0	0	0	0	3	3		
13+250	0	0	1	3	4		
13+500	0	0	1	2	3		
13+750	0	0	1	2	3		

14+0	0	0	1	4	5			
14+250	0	3	0	6	9	10	L	
14+500	0	3	1	4	8		L	
14+750	0	0	0	3	3			
15+0	0	0	0	3	3			
15+250	0	0	1	3	4			
15+500	0	0	1	3	4			
15+750	0	0	1	3	4			
16+0	3	0	1	4	8		H	
16+250	1	4	1	5	11	8	M	
16+500	0	6	0	6	12	7	L	
16+750	0	10	2	6	18	2	H	
17+0	0	10	2	6	18	2	H	
17+250	0	7	2	5	14	5	M	
17+500	0	4	0	6	10	9	L	
17+750	3	0	1	4	8		H	
18+0	1	0	1	2	4		M	
18+250	0	0	0	2	2			
18+500	0	0	1	2	3			
18+750	1	0	2	5	8		M	
19+0	0	4	0	5	9	10	L	
19+250	0	4	0	5	9	10	L	
19+500	0	0	0	5	5		L	
19+750	0	0	1	3	4			
20+0	0	0	0	3	3			
20+250	0	0	0	3	3			
20+500	0	4	0	4	8		L	
20+750	0	0	0	5	5		L	
21+0	0	0	0	2	2			
21+250	0	0	2	4	6			
21+500	0	0	1	5	6		L	
21+750	0	0	0	3	3			
22+0	0	0	0	2	2			
22+250	0	0	0	2	2			
22+500	0	0	0	2	2			
22+750	0	0	1	3	4			
23+0	0	0	1	3	4			
23+250	0	0	0	3	3			
23+500	0	0	0	3	3			
23+750	0	0	1	4	5			
24+0	3	1	1	4	9		H	
24+250	1	1	1	4	7		M	
24+500	2	0	0	2	4		H	
24+750	0	0	0	3	3			
25+0	0	0	1	2	3			
25+250	1	4	1	3	9		M	
25+500	3	4	1	3	11	8	H	
25+750	0	10	0	6	16	3	H	
26+0	0	0	0	5	5		L	
26+250	2	0	1	2	5		H	
26+500	0	0	1	3	4			
26+750	0	0	2	2	4			

27+0	0	0	0	2	2		
27+250	0	0	0	2	2		
27+500	0	0	1	2	3		
27+750	0	0	0	2	2		
28+0	0	0	0	2	2		
28+250	0	0	0	2	2		
28+500	0	0	0	2	2		
28+750	0	0	0	2	2		
29+0	0	0	1	3	4		
29+250	0	0	0	3	3		
29+500	0	0	1	2	3		
29+700	1	0	1	3	5		M
30+0	1	0	0	3	4		M
30+250	3	0	0	3	6		H
30+500	0	0	0	3	3		
30+750	0	3	1	5	9		L
31+0	0	9	0	6	15	4	M
31+250	0	9	1	6	16	3	H
31+700	0	5	2	4	11	8	L

APPENDIX 3
SUMMARY OF HERITAGE FIELDWORK

3+000-3+250	REASONS:	random low score sample
	COMMENTS:	hilly, wooded area and pasture
3+250-3+500	REASONS:	predictive environmental features-group I,
	COMMENTS:	shoreline not identified, powerline disturbance
4+500-4+750	REASONS:	predictive environmental features group I and group II, identifiable non standing historic resource location, other predictive factors
	COMMENTS:	surface of corridor largely removed by quarry operations
4+750-5+000	REASONS:	predictive environmental features group I, identifiable non standing historic resource location, other predictive factors
	COMMENTS:	surface of corridor largely removed by quarry operations
5+500-5+750	REASONS:	predictive environmental features group I and group II, other predictive factors
	COMMENTS:	surface of corridor largely removed by quarry operations
5+750-6+000	REASONS:	predictive environmental features group I, other predictive factors
	COMMENTS:	surface of corridor largely removed by quarry operations
6+250-6+500	REASONS:	predictive environmental features group I, other predictive factors
	COMMENTS:	former shoreline not identified
7+500-7+750	REASONS:	predictive environmental features group I, identifiable non standing historic resource locations, other predictive factors, random medium score sample
	COMMENTS:	not accessed - heavy vegetation
7+750-8+000	REASONS:	predictive environmental features group I, identifiable non standing historic resource locations, other predictive factors
	COMMENTS:	not accessed - heavy vegetation
8+250-8+500	REASONS:	random low score sample
	COMMENTS:	Not accessed - heavy vegetation

8+500-8+750	REASONS:	probable location group II, predictive environmental features group II, identifiable non standing historic resources, other predictive locations
	COMMENTS:	Sawdust pile at river, highway, dwelling, high water conditions
9+000-9+250	REASONS:	random low score sample
	COMMENTS:	gravel operation has removed or severely disturbed corridor surface
10+000-10+250	REASONS:	predictive environmental features group I, other predictive factors, random medium score sample
	COMMENTS:	former glacial shoreline, raised from surrounding field, recent cereal crop harvest allowed good exposure, lots of slate on surface
11+000-11+250	REASONS:	random low score sample
	COMMENTS:	ploughed field, small scatter of ceramics (ironstone), not collected, small quantities of charcoal throughout ploughed field
16+000-16+250	REASONS:	predictive environmental features group I
	COMMENTS:	former glacial shoreline, clear cut, severely disturbed by skidders etc., shoreline not identified, many erosional scars etc.
16+500-16+750	REASONS:	predictive environmental features group II, other predictive factors
	COMMENTS:	area presently scene of logging and gravel quarry operation
16+750-17+000	REASONS:	nonstanding historic features, other predictive factors, predictive factors group II
	COMMENTS:	extreme high water conditions made bank/shore inspection impossible, on oxbow of Quisibis River small gravel quarry operations, camps, considerable stabilization of right bank prevents archaeological inspection of shore, 2m terrace 100m back from right bank, 'pumpkinseed' gravels, small quantities of charcoal flecking, gravel quarry operations 250m from right bank

17+000-17+250	REASONS:	probable location group II, predictive environmental features group II, identifiable non standing historic resources, other predictive factors
	COMMENTS:	Quisibis River oxbow, flood conditions, field on left bank above oxbow between road and river stratified, silts to approximately 50cm, then sand, water table at 55cm
17+250-17+500	REASONS:	probable location group II, predictive environmental features group II, identifiable non standing historic resources, other predictive factors random medium score sample
	COMMENTS:	predominately covered by heavy evergreen growth
17+750-18+000	REASONS:	predictive environmental features group I, identifiable non standing historic resources, other predictive factors
	COMMENTS:	access difficult due to thick vegetation in area of 17+750-18+000, confidence level of shoreline identification low
18+000-18+250	REASONS:	predictive environmental features group I, identifiable non-standing historic resources, other predictive factors random medium score
	COMMENTS:	tree plantation at 18+250 end
20+500-20+750	REASONS:	random low score sample
	COMMENTS:	small overflowing stream, steep valley walls, heavy ATV use, shale bedrock exposed
24+000-24+250	REASONS:	predictive environmental features group I, probable location group II, identifiable non-standing historic location, other predictive factors
	COMMENTS:	small scale gravel quarry, now reverting to alders, good erosional face, mammalian bone recovered
24+500-24+750	REASONS:	predictive environmental features group I, other predictive factors
	COMMENTS:	small scale gravel quarry, field on raised terrace, close to Siegas River
25+500-25+750	REASONS:	predictive environmental features group I, predictive environmental factors group II, identifiable non-standing historic resources, other predictive factors

	COMMENTS:	outside corridor on access road is large deposit of gravel (glacial) 75m x 100m x 15m., found in this geological feature are remains of a large stone foundation (pre 1900 barn?) small scale gravel quarry, excellent soil profile of glacial lake deposits, location of non cultural problematical flake
25+750-26+000	REASONS:	probable location group II, predictive environmental features group II, other predictive factors
	COMMENTS:	small los floodplain, silt, beaverdam, 1 m terrace 50 m from right shore of Siegas River
26+250-26+500	REASONS:	predictive environmental features group I, identifiable non standing historic resources,other predictive factors
	COMMENTS:	rapid rise in first 10 meters of elevation on left bank of Siegas, glacial shoreline not identified
30+000-30+250	REASONS:	predictive environmental features group I, other predictive factors, random sample medium score
	COMMENTS:	recent excavations to install underground cable, therefore extensive surface area to examine
30+250-30+500	REASONS:	predictive environmental features group I, other predictive factors
	COMMENTS:	recent excavations to install underground cable, therefore extensive surface area to examine
31+250-31+500	REASONS:	probable location group II, predictive environmental features group II, other predictive factors
	COMMENTS:	disturbed by TCH, Irving mill, hydro line, residence, stabilization of left bank, oxbow scars no longer evident on surface likely a result of mentioned activity and farming
31+500-31+750	REASONS:	probable location group II, predictive environmental features group II, identifiable non standing historic resources, other predictive factors, random sample low score
	COMMENTS:	disturbed by TCH, Irving mill, hydro line, residence, stabilization of left bank, oxbow scars no longer evident on surface likely a result of mentioned activity and farming